masses of water, and that by this constantly exerted force the columns are rent asunder and fall into the chasm, taking with them huge and deep flakes of the precipice. At low-water heaps of these blocks, as yet angular and unreduced, may be seen in the shallower ends of the chasm.

While there are signs some distance away that the basalt-flows are bedded in various degrees of tenacity, there is no sign of undermining of the rock that forms the rim, as at Niagara, and so leaving that rim without support; rather does the lower portion of the precipice at places protrude outwards. But the breaking down of the rock is mostly columnar; hence the almost vertical walls of falls, chasm, gorge, and cañon.

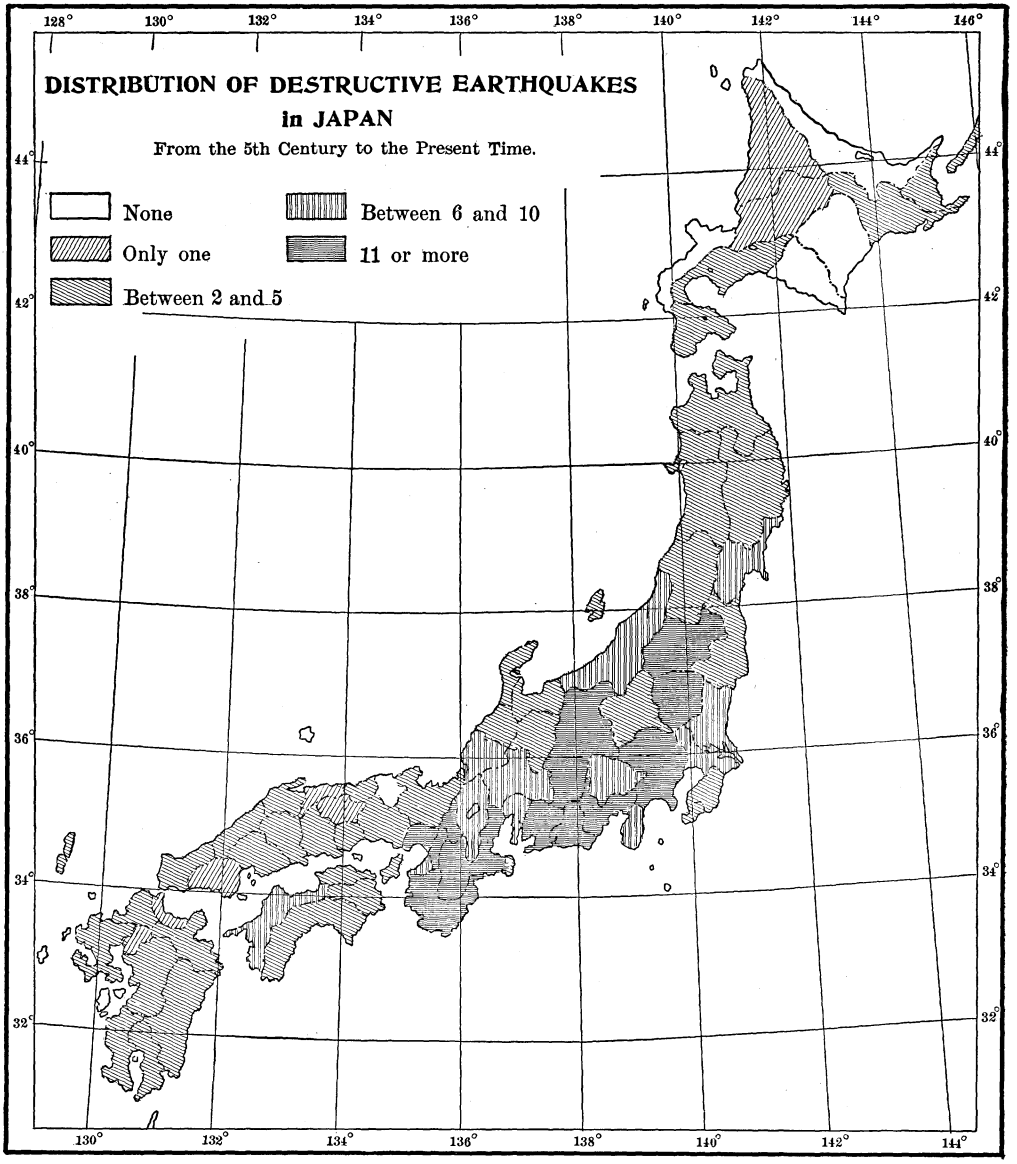
The writer thinks such are the causes that have played the most important rôle in the trenching of this length of forty miles.

EARTHQUAKES IN JAPAN.

The number of earthquakes in Japan in the year 1903 was 1,349. The *Publications of the Earthquake Investigation Committee*, No. 19, says that this is by no means more than the annual average. While Japan is pre-eminently a land of earthquakes, the shocks that are sufficiently severe to cause loss of life or serious damage to property are not numerous when compared with the total number of movements. Since 1872 fifteen earthquakes in Japan have been attended with serious consequences. It is only within a comparatively short time that the invention of the seismograph has made it possible to take note of the minor shocks; but over 2,000 earthquakes were recorded in the history of Japan between 416 and 1867 of the Christian Era.

The accompanying map is taken from No. 19 of the *Publications*. It shows the distribution of earthquakes that have caused loss of life and large destruction of property in Japan from the Fifth Century to the present time. There have been in all 223 of these violent earthquakes; 149 were limited in their destructive effects to one province of the empire and 74 extended over two or more provinces. Destructive earthquakes on the concave or Japan Sea side of the archipelago, as a rule, have smaller extent than those which occur on the convex or Pacific side. Of the 223 destructive

earthquakes, the place of origin of 47 was plainly in the Pacific; of 17, in the Japan Sea; of 2, in the Inland Sea; while the epicen-



tral tract or place of origin of 114 was inland, and the origin of 43 shocks was obscure. Of the 47 destructive earthquakes of Pacific origin, 23 were accompanied by *tsunami* or sea-waves, which have

often caused much more damage than the earthquakes themselves.

It is seen from another map in the *Publications* that the sea-waves accompanying earthquakes are almost entirely confined to the Pacific coast, there being only two exceptions.

One of the most destructive earthquakes was the great Mino-Owari catastrophe in October, 1891, in which over 7,000 people were killed, over 17,000 injured, and nearly 20,000 buildings destroyed, besides many bridges and other public works. It was this calamity that led to the establishment of the Earthquake Investigation Committee to discover (1) whether there are any means of predicting earthquakes, and (2) to ascertain what may be done to reduce the disastrous effects to a minimum by the choice of proper structures, materials, building sites, etc. This Committee, taking a liberal view of its functions, has not hesitated to make any investigations that would throw light upon the whole subject. The Committee is composed of twenty-four members, all scientific men or engineers, and it has thus far published forty-seven reports in Japanese and sixteen in foreign languages, chiefly English.

The recent seismological investigations in Japan are almost wholly the work of the Committee, in conjunction with the Seismological Institute of the Tokyo University.

Its statistical work consists chiefly of collecting records and reports of earthquakes and of the destructive sea-waves that accompany some of them. From these data are deduced the distribution of earthquakes in time and area; their relation to the seasons, the phases of the moon, the time of day, and the meteorological conditions.

Instrumental observations are carried on with seismometers and seismographs. These investigations include inquiries into the construction of instruments, their improvement, the invention of new ones, etc. From these observations are deduced the nature of the vibrations of earth particles, their amplitude and period, the velocity of earthquake waves, etc. As seismographs now record earthquakes the world around, the Committee has the means of studying the effects of distant earthquakes in Japan.

The geological investigations include reports of volcanic eruptions, geological dislocations, etc. Under this heading comes also the Vulcanological Survey, whose object is "to study the new and old volcanoes of our country as regards their internal structure, their rocks, their foundations, and their modes of distribution," so

as to be able to get "an insight into the structure of the land"; and "to construct the geotectonic map, by means of which we may possibly learn the conditions underground and the causes of regional shaking and the local points of earthquakes."

There are also investigations of such physical phenomena as may have some relation with seismic phenomena with a view to ascertaining whether such relation actually exists, and, if so, what is its nature. Among these are earth magnetism, gravity, underground temperatures, and elasticity of rocks.

A practical side of the work is one of the two ultimate objects for which the Committee was organized. It comprises investigations of earthquake-proof structures, best forms of chimneys, piers, columns, etc.; the strength of materials and combinations of materials, and so on. The committee has also extended its work to the application of seismometrical instruments, to the measurement of vibrations of the ground, and of vibrations of buildings and structures, due to causes other than earthquakes, such as passing of trains over bridges, hammering in factories, and the like, and to an examination of their effects.

The Committee has given much study to the construction of brick and wooden buildings that shall be as nearly earthquake-proof as possible. A number of plans and elevations of such buildings, and the methods of bracing and strengthening them so that they shall offer all possible resistance to earth movement, appear in *Publication* 19.

An International Seismological Association is now in course of organization. It is expected primarily to concern itself with the study and discussion of earth movements. The hope is expressed by the Japanese Earthquake Investigation Committee that it may, either by itself or in co-operation with other bodies, take into consideration all the principal problems relating to seismology.

The Japanese Committee has done some work which in its application will be useful in many countries. Such results, for example, as the determinations of the vibrations of railroad bridge piers, of the deflection and vibrations of girders and trusses, of vibrations of railroad and electric cars and of ships, will be of interest and use to engineers in all parts of the world.

The report says with regard to the prediction of earthquakes that it is not to be expected that the Committee should be able to accomplish so difficult a task within a short time; but there is no reason to assume that by persevering in this and other lines of investigation such a knowledge of earthquakes may not finally be

attained as to justify earthquake predictions. This view will probably be regarded as sanguine by the important number of seismologists who say that, as yet, not a particle of progress has been made in this direction, and who believe that predictions of some merit, but still large liability to error, would almost be worse for the people of earthquake countries than the calamities themselves.

LAUNCHING OF THE "ROOSEVELT."

The Peary Arctic Club's new ship was launched at Bucksport, Me., March 23, at 12.35 P.M.

Conditions of weather and tide were particularly favourable, and the event was characterized throughout by uniform smoothness.

When the binding timbers which held the ship on the ways were severed, Mrs. Peary smashed a bottle of champagne, imbedded in a block of ice, against the ship's stem, and christened her "Roosevelt."

The ship slid slowly and smoothly into the water, and moved gracefully across the narrow channel of the Penobscot, where she was taken in charge by a tug and towed to her pier.

Telegrams were immediately sent to President Roosevelt, and President Jesup, of the Club.

Some 5,000 visitors witnessed the launching, and greeted the vessel and her name with cheers.

The official measurements of the ship are: length, 182 feet; breadth, 35.5 feet; depth, 16.2 feet. Her mean draft will be 16 feet, and her full load displacement about 1,500 tons.

The preliminary plans and studies of the ship, embodying Peary's ideas, were prepared by Wm. E. Winant, Naval Architect in the Bureau of Construction and Repair of the Navy.

On these plans expert opinions were secured, and various modifications made. Finally the massive construction and essential special features of the ship were clothed by the builder, Capt. Chas. B. Dix, of the firm of McKay & Dix, in the graceful lines of our Maine-built coasting schooners.

Noticeable features of the "Roosevelt" are the pronounced rake of her stem, sharp wedge-form of the bows, a raking rudder-